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Kim et al.

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(54) **INITIATOR FOR ROCKET MOTOR**

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CPC ***F42B 3/124*** (2013.01)

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USPC 102/202, 202.5, 202.7, 202.9, 202.14
See application file for complete search history.

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(57) **ABSTRACT**

Provided is an initiator for a rocket motor. The initiator for a rocket motor includes: a sleeve assembly configured to form a hollow portion; and an ignition assembly including a plug portion mounted on the sleeve assembly to close one side of the hollow portion and configured to deliver an electrical signal and a foil ignition portion coupled to the inside of the plug portion to be adjacent to the hollow portion. The sleeve assembly includes: a first gunpowder accommodated in the hollow portion to be adjacent to the foil ignition portion and detonated by the foil ignition portion; and a second gunpowder accommodated inside the hollow portion to contact the first gunpowder and deflagrated or combusted by the detonation of the first gunpowder.

3 Claims, 3 Drawing Sheets

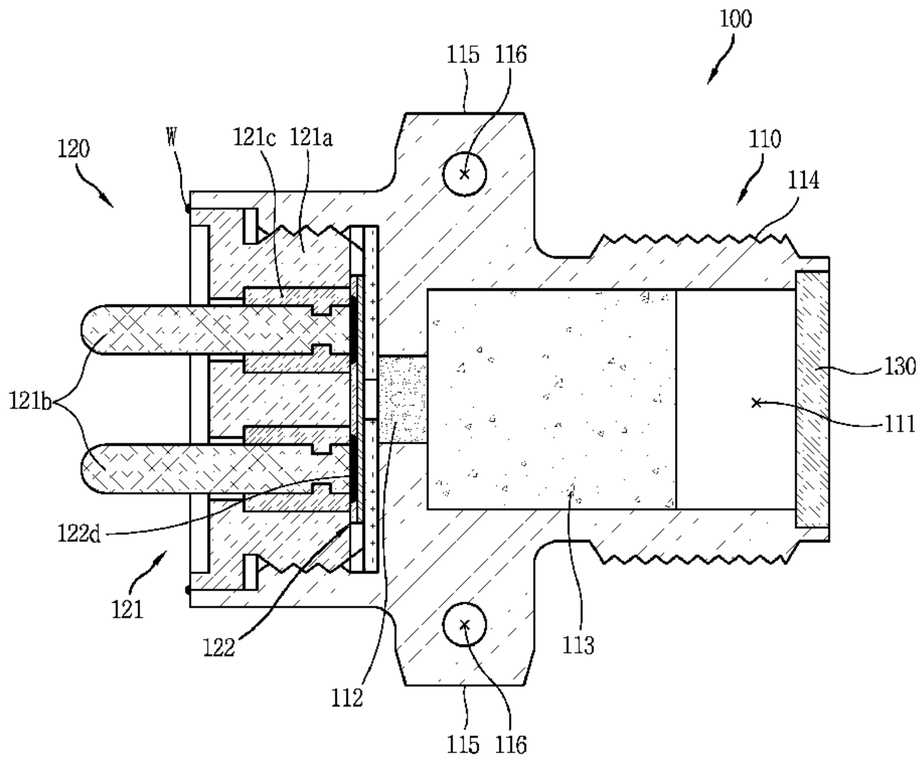

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FIG. 1

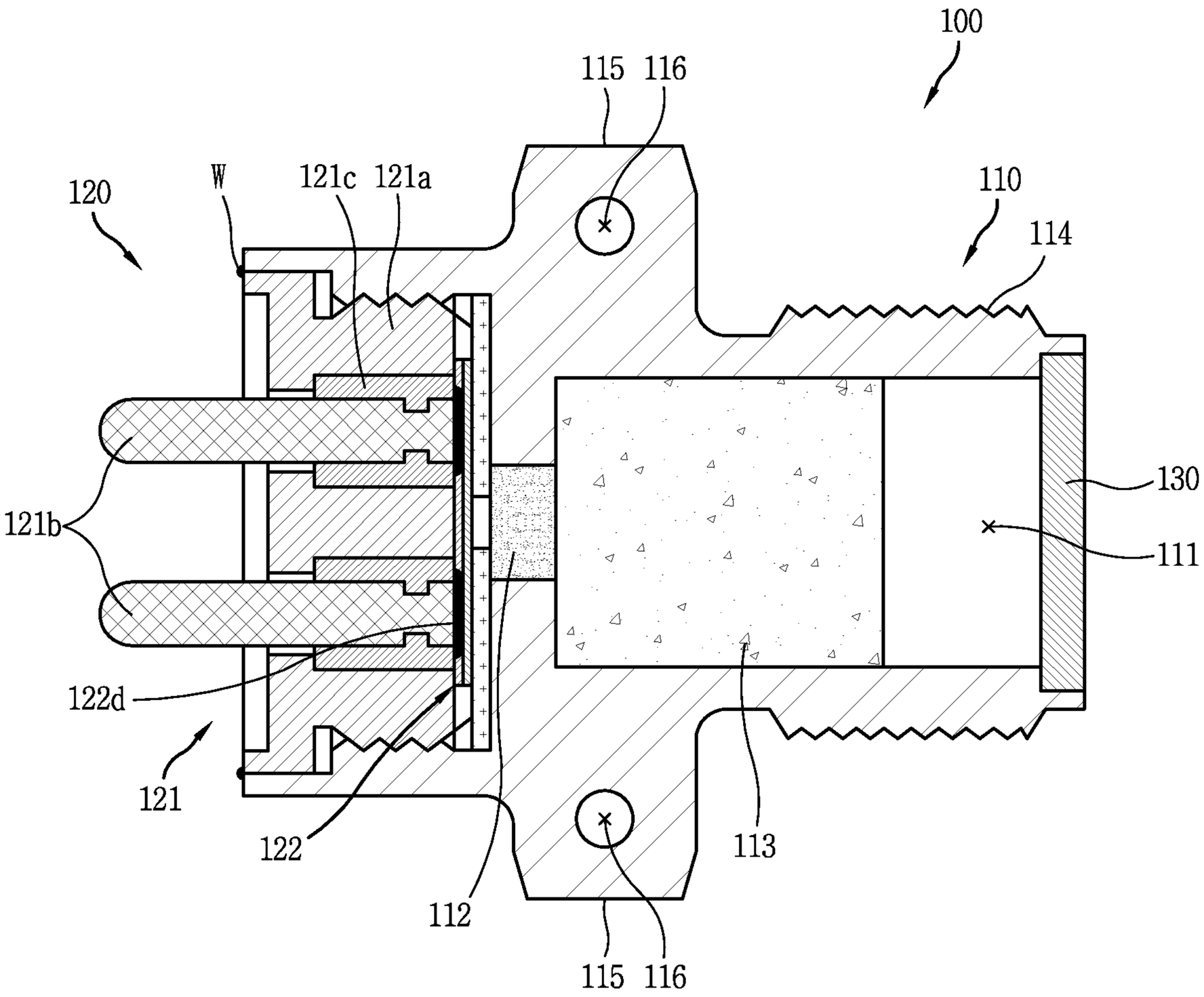

100
115
116
120
W
121c
121a
110
114
121b
130
111
122d
121
122
112
113
115
116

FIG. 2

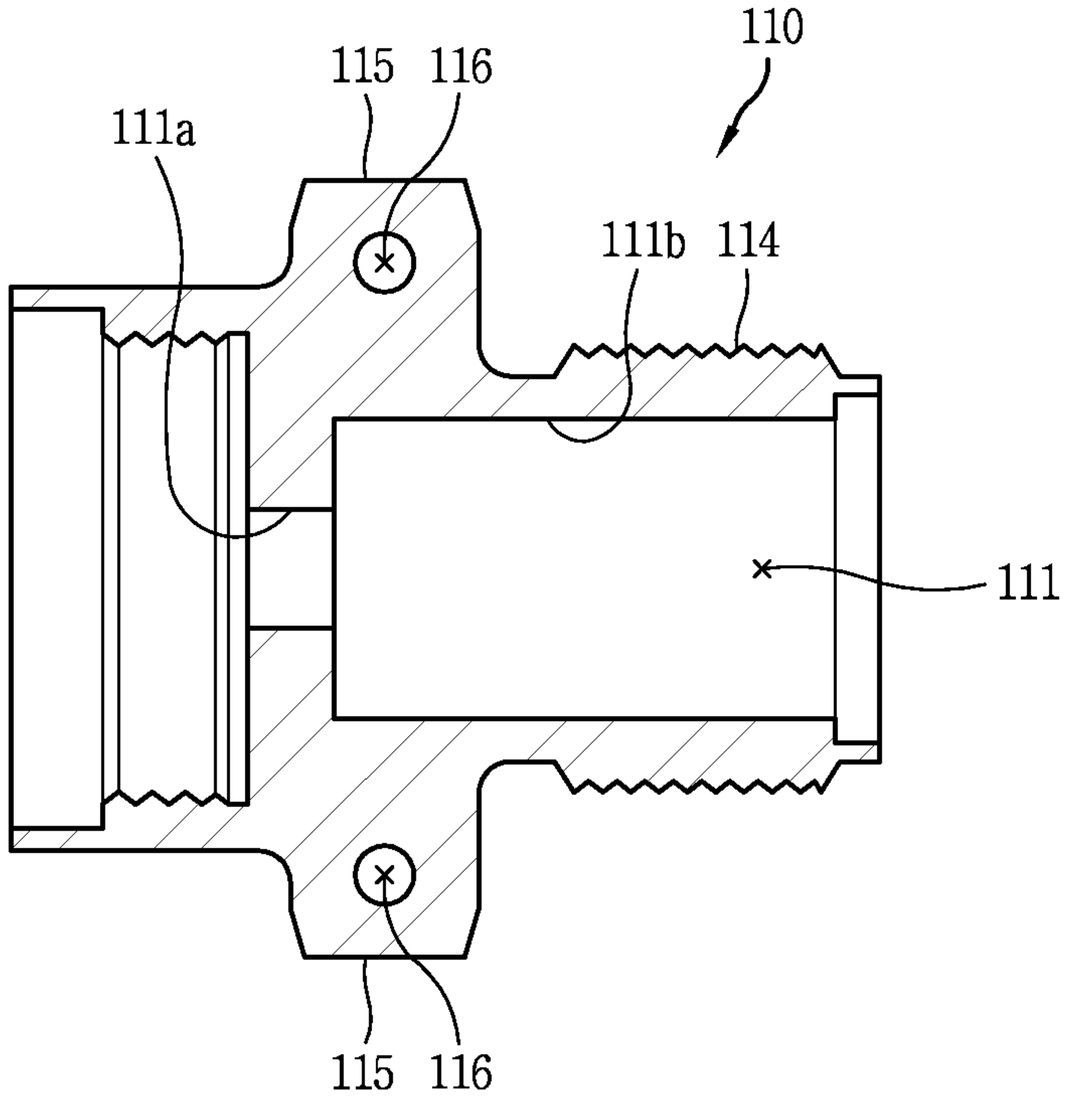

110
115
116
111a
111b
114
111
115
116

FIG. 3

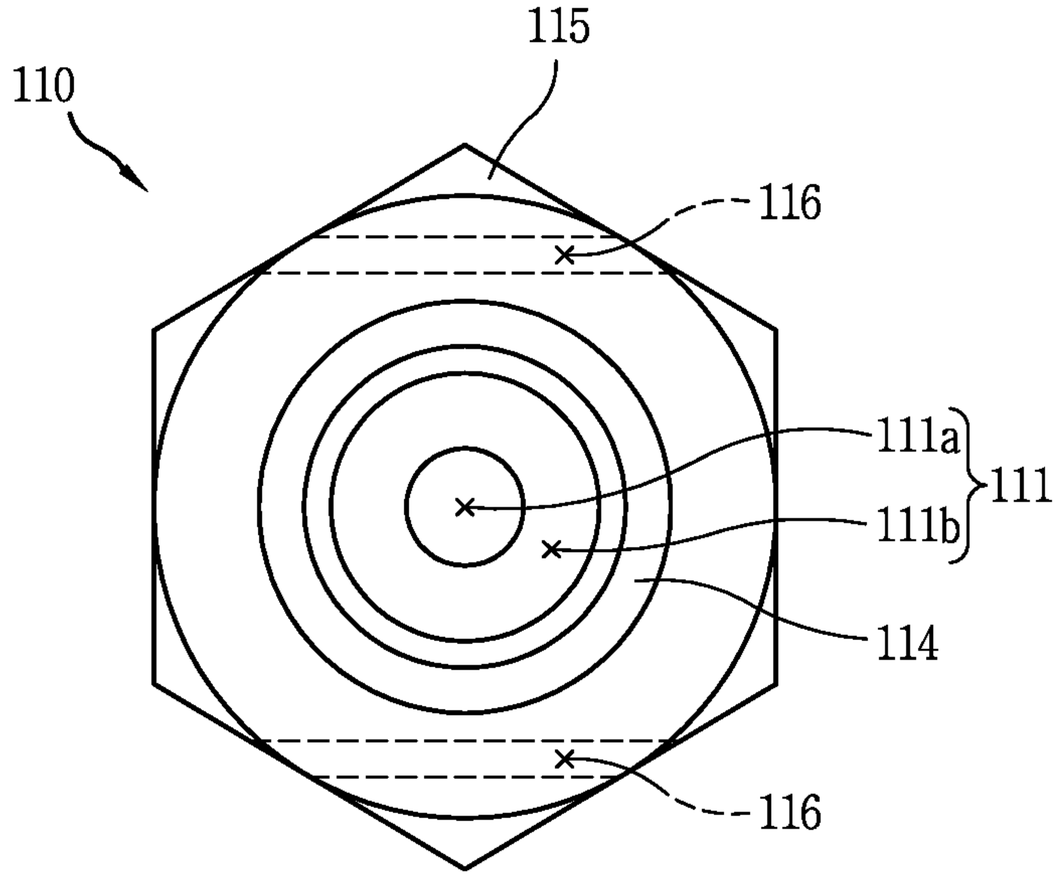

115
110
116
111a
111b
111
114
116

FIG. 4

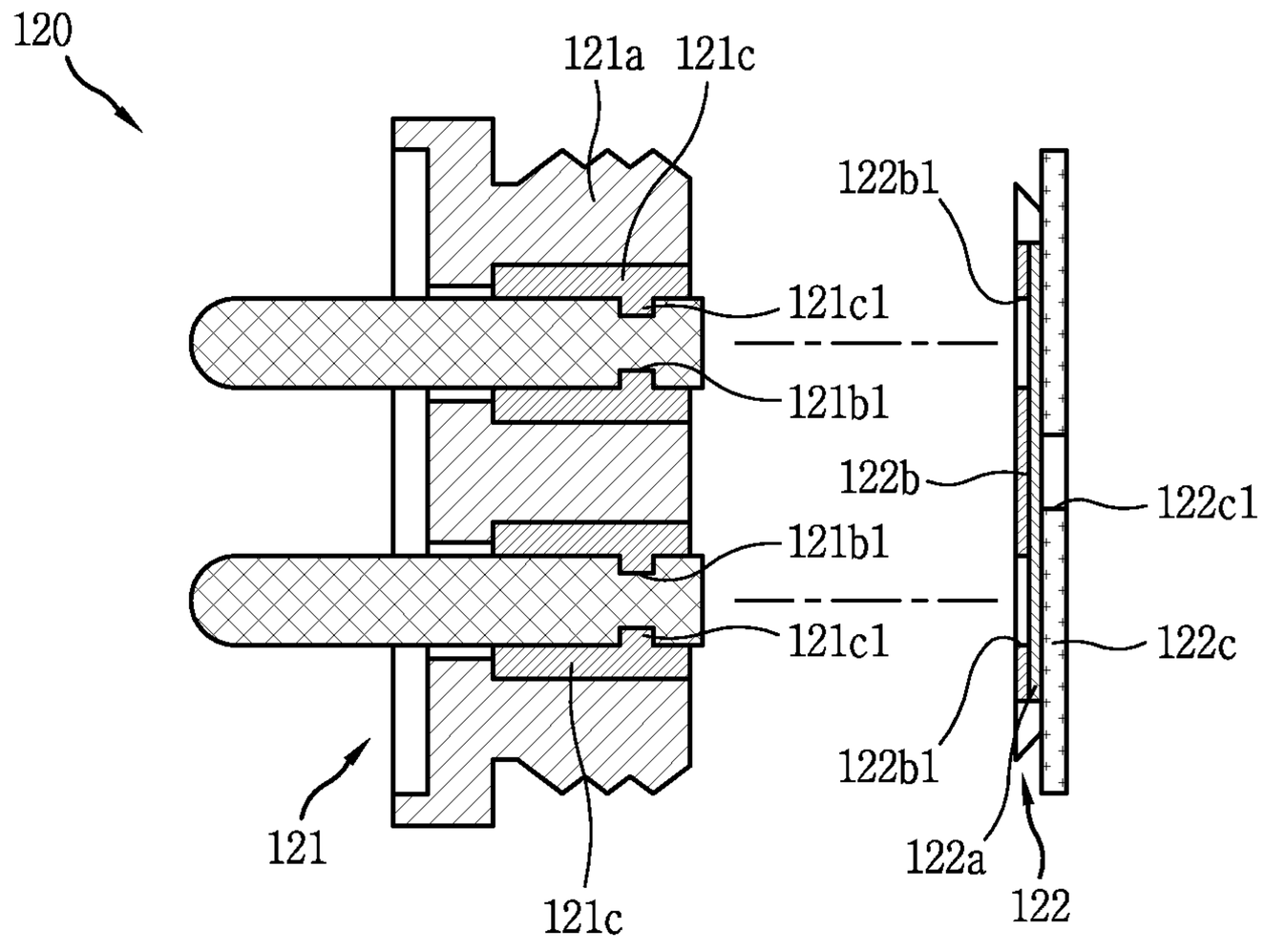
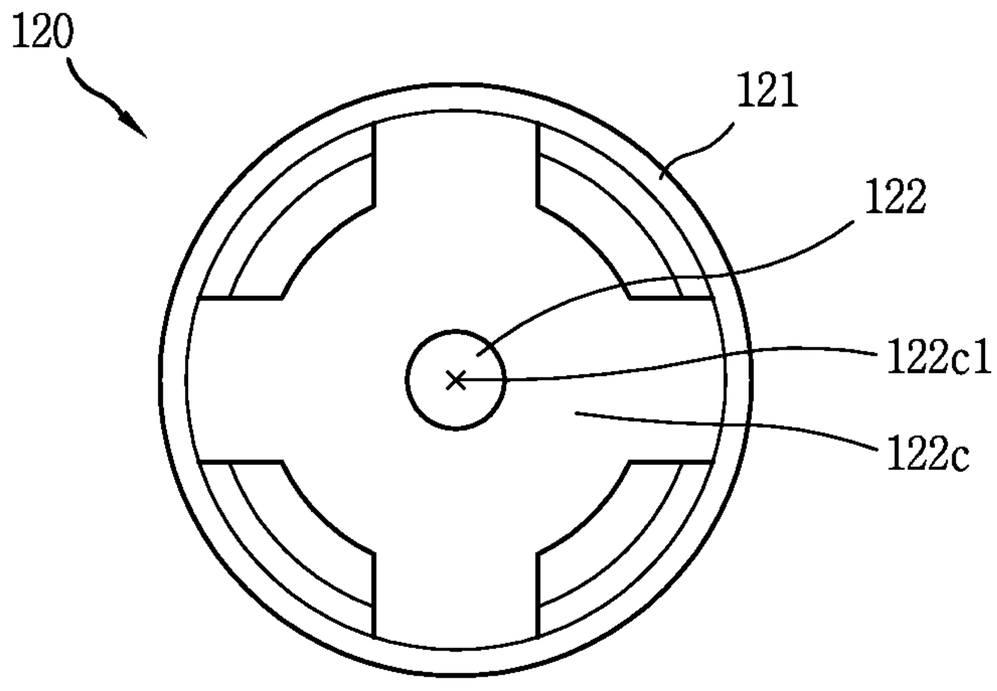

120
121a
121c
122b1
121c1
121b1
122b
122c1
121b1
121c1
122c
122b1
121
121c
122a
122

FIG. 5


120
121
122
122c1
122c

INITIATOR FOR ROCKET MOTOR

CROSS-REFERENCE TO RELATED APPLICATION

Pursuant to 35 U.S.C. § 119(a), this application claims the benefit of earlier filing date and right of priority to Korean Application No. 10-2017-0048096, filed on Apr. 13, 2017, the contents of which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an initiator for a rocket motor which is operated by an exploding foil initiator to ignite a rocket motor.

2. Background of the Invention

An exploding foil initiator is also called High Voltage Initiator, and is generally operated at a high voltage of 1000 V or more.

The exploding foil initiator operates in a mechanism in which a metal thin film bridge is vaporized and converted to plasma as voltage is applied, a thin Polyimide film is scattered along with the plasma on a thin film, and explosion occurs when a secondary explosive such as Hexanitrostilbene (HNS)-IV is encountered.

Originally, the exploding foil initiator is designed as a detonator for missile warheads and has the advantage that it can be used directly in connection with a warhead high-explosive without additional safeguards due to the complicated operating conditions (Patent Document 1). In addition, the exploding foil initiator was used as a trigger device for a Cartridge Actuated Device (Patent Document 2). Since the exploding foil initiator is mostly used at the end of the mission, it is used for a detonation using high-explosive such as HNS. Therefore, during the detonation of a general exploding foil initiator, the housing of the initiator is also destroyed, so that the shape before operation may not be maintained.

On the other hand, when the exploding foil initiator is used for igniting a rocket motor, a new design is required to prevent the destruction of the initiator housing by chemical detonation. This is because the initiator used for a rocket motor should withstand the combustion pressure during the combustion of the rocket motor even after the initiator operates. If the initiator housing is destroyed when the exploding foil initiator is operated, the propulsion engine may be ignited but immediately, the combustion gas of the propulsion engine is leaked through the exposed initiator assembly and exposed to high temperature and high pressure, so that immediately the propulsion system will be detonated.

Patent Document 3 discloses an exploding foil initiator designed for use in the igniter of a propulsion engine. Like the existing exploding foil initiator, when a metal thin film is converted to plasma, a polyimide film piece is scattered and collided with a secondary gun powder such as HNS, so that this initiator starts to operate. However, in order to prevent destruction of the initiator housing by detonation such as high-explosive such as HNS, a small amount of high explosive is used and an output charge to supply ignition energy is used separately. At this time, the output charge, as a gunpowder having a characteristic of deflagration or combustion, is combusted during operation to generate gas but prevents damage of the initiator housing structure.

However, the initiator of Patent Document 3 is assembled so that the output charge is contained in the metal case and closely contacted with the explosive in order to initiate the combustion of the output charge due to the explosion pressure and heat generated by a minute high explosive. In addition, an auxiliary reactant is installed between the high explosive and the output powder so that the energy generated when the high explosive is detonated is well delivered to the output charge. In addition, Patent Document 3 discloses a complicated structure in which a terminal for electrically connecting an electrode of an initiator to a metal thin film is mounted.

As described above, the initiator as in the conventional Patent Document 3 is designed to transmit energy through various stages and structures until the final deflagration or combustion. Therefore, if more simplified components and ignition mechanisms are devised, there is room for improvement in reliability of an initiator for a rocket motor in addition to miniaturization.

(Patent Document 1) U.S. Pat. No. 8,281,718 B2 (Registered on 2012 Oct. 9)

(Patent Document 2) U.S. Pat. No. 8,037,824 B1 (registered on 2011 Oct. 18)

(Patent Document 3) U.S. Pat. No. 7,661,362 B2 (registered on 2010 Feb. 16)

SUMMARY OF THE INVENTION

Therefore, an aspect of the detailed description is to provide an initiator for a rocket motor with a simple housing internal structure in which gunpowder for continuous ignition is accommodated.

Another aspect of the detailed description is to provide an initiator for a rocket motor with a structure in which an exploding foil initiator and a plug are connected to each other in a simple manner inside the housing.

To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, there is provided an initiator for a rocket motor including: a sleeve assembly configured to form a hollow portion; and an ignition assembly including a plug portion mounted on the sleeve assembly to close one side of the hollow portion and configured to deliver an electrical signal and a foil ignition portion coupled to the inside of the plug portion to be adjacent to the hollow portion, wherein the sleeve assembly includes: a first gunpowder accommodated in the hollow portion to be adjacent to the foil ignition portion and detonated by the foil ignition portion; and a second gunpowder accommodated inside the hollow portion to contact the first gunpowder and deflagrated or combusted by the detonation of the first gunpowder.

The plug portion may include: a body portion inserted in the sleeve assembly; and a plurality of pins extending to penetrate the body portion.

An inner end facing the hollow portion of the pin may be formed as a plane cut surface to be adhered to a surface of the foil ignition portion.

An outer end of the pin may be formed to be convex in a spherical shape.

The foil ignition portion may include: an ignition layer including a bridge vaporized by voltage application; an insulating layer disposed on one side of the ignition layer and including a plurality of pin accommodating holes; and

a spacing layer disposed on the other side of the ignition layer and including a through hole formed to expose the bridge to the other side.

The plug portion may further include a sealing member interposed between the body portion and the pin to surround the outer circumferential surface of the pin and including a protrusion portion protruding to be accommodated in an accommodating groove recessed at the outer circumferential surface of the pin.

The accommodating groove may extend to surround the outer circumferential surface of the pin, and the protrusion portion may be formed in an annular shape to be accommodated in the accommodating groove.

The sleeve assembly may include: a screw fastening portion screw-coupled to a rocket motor and inserted therein; a fastener coupling portion having a portion of the outer circumferential surface protruded or recessed to engage with a fastening tool for the screw fastening; and a wire accommodating portion formed to penetrate the fastener coupling portion and accommodate a fastening wire connected to the rocket motor.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. **1** is a sectional view showing an initiator for a rocket motor according to the present invention;

FIG. **2** is a cross-sectional view showing a portion of a sleeve assembly shown in FIG. **1**;

FIG. **3** is a rear view showing a portion of a sleeve assembly shown in FIG. **2**;

FIG. **4** is a cross-sectional view showing an ignition assembly shown in FIG. **1**; and

FIG. **5** is a rear view showing an ignition assembly shown in FIG. **4**.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, an initiator for a rocket motor related to the present invention will be described in detail with reference to the accompanying drawings.

In describing exemplary embodiments disclosed in this specification, a specific description for publicly known technologies will be omitted when it is judged that the description obscures the gist of the embodiments disclosed in the specification.

Also, it should be understood that the accompanying drawings are merely illustrated to easily explain exemplary embodiments disclosed in this specification, and therefore, they should not be construed to limit the technical ideas disclosed in this specification but be construed to cover all modifications and alternatives falling within the spirit and scope of the present invention.

The singular expressions include plural expressions unless the context clearly dictates otherwise.

The initiator for a rocket motor is a device that supplies ignition energy to start combustion of a rocket motor (also referred to as a rocket engine, or a propulsion engine). In particular, an exploding foil initiator for rocket motors is required to maintain the structure to be tightly closed after ignition. Hereinafter, the structure and functions of an initiator for a rocket motor according to the present invention will be described with reference to the drawings.

FIG. **1** is a sectional view showing an initiator for a rocket motor **100** according to the present invention. In addition, FIG. **2** is a sectional view showing a sleeve assembly **110** shown in FIG. **1**, and FIG. **3** is a rear view showing the sleeve assembly **110** shown in FIG. **2**.

Referring to FIGS. **1** to **3**, the initiator for a rocket motor **100** according to the present invention includes a sleeve assembly **110** and an ignition assembly **120**. The sleeve assembly **110** accommodates gunpowder through which energy for ignition is generated and maintains the sealed structure even after the detonation action of the gunpowder. Then, the sleeve assembly **110** serves to receive electrical energy to ignite the gunpowder accommodated in the sleeve assembly **110**.

First, the sleeve assembly **110** is configured to form a hollow portion **111**. As shown in FIGS. **1** and **2**, the sleeve assembly **110** has a cylindrical shape extending in one direction (e.g., the left and right directions in FIGS. **1** and **2**). The hollow portion **111** formed in the sleeve assembly **110** may extend in one direction to open both ends and may have a shape in which a plurality of cylindrical spaces are concentrically connected.

Meanwhile, the ignition assembly **120** includes a plug portion **121** and a foil ignition portion **122**. The plug portion **121** serves as an electrical connection portion for delivering electrical energy to the initiator for a rocket motor **100** according to the present invention. As shown in FIG. **1**, the plug portion **121** is mounted to the sleeve assembly **110** to close one end of the hollow portion **111**. Then, the foil ignition portion **122** is mounted on the inner surface of the plug portion **121** and is disposed adjacent to the hollow portion **111**.

The foil ignition portion **122** may be a portion operated by the mechanism of an exploding foil initiator in the initiator for a rocket motor **100** according to the present invention. That is, when the foil ignition portion **122** is applied with a high voltage of approximately 1000 V from the plug portion **121**, a bridge **122***d* formed for narrowing the cross-sectional area of a wire on the thin film structure may be vaporized and converted to plasma by heat generation. At this time, a polyimide film formed adjacent to the bridge **122***d* is scattered together, so that the ignition action may be performed. Specific features of the foil ignition portion **122** of the present invention will be described later.

In the initiator for a rocket motor **100** according to the present invention, the sleeve assembly **110** includes first gunpowder **112** and second gunpowder **113**, and they are installed adjacent to each other, so that a simple structure may be realized.

The first gunpowder **112** is accommodated in the hollow portion **111** to be adjacent the foil ignition portion **122**. As shown in FIG. **1**, the first gunpowder **112** may be accommodated in a first hollow **111***a* having a relatively small inner diameter and a cylindrical space adjacent to the foil ignition portion **122** in the hollow portion **111**.

The first gunpowder **112** may be made of a high explosive such as Hexanitrostilbene (HNS)-IV and may be detonated by a piece of polyimide film scattered with plasma. This first gunpowder **112** may be set to an amount that prevents structural damage to the sleeve assembly **110** at the time of detonation.

The second gunpowder **113** is accommodated in the hollow portion **111** so as to contact the first gunpowder **112**. As shown in FIG. **1**, the second gunpowder may be filled in a second hollow **111***b*, which is a cylindrical space with a

relatively larger inner diameter than the first hollow **111***a* and adjacent to the first hollow **111***a* in the hollow portion **111**.

The second gunpowder **113** may be made of, for example, $BKNO_3$. The second gunpowder **113** is deflagrated or combusted by detonation of the first gunpowder **112**. In particular, since the energy due to the detonation of the first gunpowder **112** is directly accommodated and reaction occurs, the ignition energy may be supplied to a rocket motor.

On the other hand, the other end of the hollow portion **111** may be closed by a sleeve cap **130**. The sleeve cap **130** may be welded to the sleeve assembly **110** to seal the hollow portion **111**. In particular, the sleeve cap **130** seals the second gunpowder **113** filled in the second hollow **111***b* from the outside, thereby preventing performance deterioration due to moisture infiltration. The airtightness inside the hollow portion **111** by the sleeve cap **130** may be provided to maintain 10^{-6} He/cc.

As the first gunpowder **112** and the second gunpowder **113** may be formed to be in contact with each other, the initiator for a rocket motor **100** according to the present invention may be simply configured with the hollow portion **111** where the structure of the sleeve assembly **110** communicates with one space. Further, it is not necessary to separately provide a structure such as a metal case for separating the first gunpowder **112** and the second gunpowder **113** from each other. Therefore, the present invention may be configured concisely with a small number of parts, so that assembly convenience can be improved. Furthermore, there is an advantage that a smaller size initiator can be manufactured easily.

On the other hand, in relation to the present invention in which a separate case structure is omitted, the amounts of the first gunpowder **112** and the second gunpowder **113** need to be appropriately designed in consideration of interaction therebetween. Specifically, if the amount of first gunpowder **112** is greater than necessary, there is a risk that the structure of the sleeve assembly **110** will be damaged due to its detonation force. Conversely, if the amount of the first gunpowder **112** is excessively small, the second gunpowder **113** may not sufficiently provide reaction, so that the ignition energy is not sufficiently supplied to the rocket motor.

Therefore, as the first gunpowder **112** and and the second gunpowder **113** of the present invention, the sleeve assembly **110** of the present invention may be filled with 5 mg to 15 mg of the first gunpowder **112** made of HNS and 100 mg to 200 mg of the second gunpowder **113** made of $BKNO_3$. That is, the first gunpowder **112** may be accommodated in the sleeve assembly **110** of the present invention to have a value of 2.5% to 15% of the mass of the second gunpowder **113**.

As described above, since the mass of each of the first gunpowder **112** and the second gunpowder **113** has an optimum design value, the sealing of the sleeve assembly **110** of the present invention may be maintained even after ignition and sufficient ignition energy may be supplied to the rocket motor.

In the above, in relation to the initiator for a rocket motor **100** according to the present invention, structural features in which the first gunpowder **112** and the second gunpowder **113** are accommodated in the sleeve assembly **110** are described. Structural features of the ignition assembly **120** of the initiator for a rocket motor **100** according to the present invention will be described below with reference to FIGS. **4** and **5**.

FIG. **4** is a sectional view showing the ignition assembly **120** shown in FIG. **1**, and FIG. **5** is a rear view showing the ignition assembly **120** shown in FIG. **4**. As mentioned above, the ignition assembly **120** includes a plug portion **121** and a foil ignition portion **122**. The plug portion **121** may include a plug body **121***a* configured to be inserted into the sleeve assembly **110** and a plurality of pins **121***b* extending through the plug body **121***a*.

The plug body **121***a* may be screw-coupled to a portion of the inner circumferential surface of the hollow portion **111** to seal one side of the hollow portion **111**. In addition, after being screw-coupled, the plug body **121***a* and the sleeve assembly **110** are welded together to ensure additional sealing. Specifically, the outer circumferential surface end of the plug body **121***a* shown in FIG. **1** and the inner circumferential surface end of the hollow portion **111** in contact therewith may be welded (w) to each other in order for sealing.

The pin **121***b* shown in FIGS. **1** and **4** is a configuration for applying voltage to the foil ignition portion **122**. The pin **121***b* is a structure constituting an electrode, and two pins **121***b* may be arranged in parallel so as to pass through the plug body **121***a*.

Particularly, the initiator for a rocket motor **100** according to the present invention is characterized in that the foil ignition portion **122** and the pin **121***b* are bonded to each other through adhesion. To this end, one end (the right end in FIGS. **1** and **4**) of the pin **121***b* inserted toward the hollow portion **111** may be a plane cut surface. An adhesive material such as a conductive epoxy may be applied to the cut surface of the plane formed on the pin **121***b* and may be fixed as so to apply an electric current to an electric circuit formed on one surface of the foil ignition portion **122**.

In addition, the other end (the left end of FIGS. **1** and **4**) of the pin **121***b* inserted into the hollow portion **111** may have a convex spherical shape. Such a shape may contribute to improvement in convenience when a socket for supplying an electric signal to the plurality of pins **121***b* is assembled.

Moreover, in particular, as shown in FIG. **4**, the foil ignition portion **122** may include an ignition layer **122***a*, an insulating layer **122***b*, and a spacing layer **122***c*. The ignition layer **122***a* serves to detonate the first gunpowder **112** by the mechanism of the exploding foil initiator described above. The ignition layer **122***a* may include a bridge **122***d* layer (not shown) made of a conductive material and a polyimide layer scattered when the bridge **122***d* is converted to plasma. In the ignition layer **122***a*, the plane cut surface of the pin **121***b* described above may be attached so as to directly apply an electric current to the bridge **122***d*. The insulating layer **122***b* may be formed to cover one side of the ignition layer **122***a*. However, a plurality of pin accommodating holes **122***b***1** may be formed in the insulating layer **122***b* so as to realize contact between the ignition layer **122***a* and the pin **121***b*. In particular, the pin accommodating hole **122***b***1** may be utilized as an alignment reference when the foil ignition portion **122** and the plug portion **121** are assembled.

The spacing layer **122***c* may be formed to cover the other side of the ignition layer **122***a*. However, a through hole **122***c***1** may be formed in the center of the spacing layer **122***c* in order to allow a material such as polyimide, which is scattered on the ignition layer **122***a* and detonates the first gunpowder **112**, to penetrate. In addition, the spacing layer **122***c* is formed to have a predetermined thickness, and serves to secure a separation distance between the ignition layer **122***a* and the first gunpowder **112**. That is, the thickness of the spacing layer **122***c* may be designed as a distance such that the polyimide of the ignition layer **122***a* can be accelerated sufficiently to detonate the first gunpowder **112**.

In addition, the spacing layer **122***c* may serve to physically support and protects the ignition layer **122***a* that can be made of a thin film of copper.

According to the above-described coupling structure, a separate terminal component added to connect the connector and the initiator may be omitted from the initiator for a rocket motor **100** of the present invention. Therefore, miniaturization according to the reduction of the internal space may be possible, and the assembly process may be simplified.

On the other hand, the plug portion **121** forming the ignition assembly **120** of the present invention may further include a sealing member **121***c*. Hereinafter, the sealing member **121***c* serving to perform insulation and sealing between the pin **121***b* and the plug body **121***a* will be described with reference to FIGS. **1** and **4**.

The sealing member **121***c* may be formed in a cylindrical shape surrounding the outer circumferential surface of the pin **121***b*. Then, the outer circumferential surface of the sealing member **121***c* may be contacted and fixed to the inner circumferential surface of the hole formed in the plug body **121***a* so as to allow the pin **121***b* to penetrate.

Further, the sealing member **121***c* may have a protrusion portion **121***c***1** to maintain a firm coupling with the pin **121***b*. The protrusion portion **121***c***1** may have a shape protruding from the inner circumferential surface of the sealing member **121***c* and an accommodating groove **121***b***1** for accommodating the protrusion portion **121***c***1** may be formed on the outer circumferential surface of the pin **121***b*. The protrusion portion **121***c***1** and the accommodating groove **121***b***1** may extend annularly along the circumferential direction of the pin **121***b*.

The sealing member **121***c* may be made of an insulating glass material for electrical insulation. Then, a plurality of beads made of insulating glass are heated and melted while being inserted into the accommodating groove **121***b***1** so that an annular protrusion portion **121***c***1** is formed and integrally formed with the cylindrical sealing member **121***c*.

In such a manner, by mounting the sealing member **121***c* having the protrusion portion **121***c***1**, it is possible to ensure the air tightness of the combustion chamber after the ignition in addition to the accurate transmission of the electric signal. Particularly, since the sealing member **121***c* having the protrusion portion **121***c***1** is integrally formed, the structural sealing may be effectively implemented without a separate coupling member for coupling with the pin **121***b*. In addition, insulation breakage by separate fastening parts may be resolved.

The initiator for a rocket motor **100** according to the present invention is coupled to a rocket motor and operates in a state where the assembly is completed. During the detonation of the first gunpowder **112** and the deflagration and combustion process of the second gunpowder **113**, the coupling between the sleeve assembly **110** and the rocket motor should be firmly maintained in the initiator for a rocket motor **100** according to the present invention, so that leakage of high temperature and high pressure gas to the initiator for a rocket motor **100** of the present invention can be prevented.

First, the sleeve assembly **110** of the present invention may be fixed to the rocket motor by a screw fastening portion **114** formed on the outer circumferential surface. In detail, the sleeve assembly **110** can be inserted such that the side (i.e., the right side in FIG. **1**) on which the sleeve cap **130** is mounted is adjacent to the inside of the rocket motor.

A fastener coupling portion **115** may be formed on the outer circumferential surface of the sleeve assembly **110** to implement assembling easily through screw fastening. As shown in FIG. **3**, the fastener coupling portion **115** may be formed to have a hexagonal outer surface, and a nut fastening tool or the like may be fixed, so that torque for screw fastening can be effectively applied.

Further, for secondary fixing of the sleeve assembly **110** and the rocket motor, the sleeve assembly **110** of the present invention may include a wire accommodating portion **116**. As shown in FIGS. **2** and **3**, the wire accommodating portion **116** may be formed of at least one hole penetrating the fastener coupling portion **115** in one direction.

After the sleeve assembly **110** and the rocket motor are coupled to each other through the fastening screw portion, a lock wire may be inserted into the wire accommodating portion **116** to perform secondary fixing. Like the wire accommodating portion **116**, a structure capable of accommodating or fixing the lock wire may be formed at the rocket motor.

As the wire accommodating portion **116**, i.e., a secondary fastening means, is provided, even if vibration or shock occurs during rocket transportation or shock occurs during combustion of the initiator for a rocket motor **100** or the rocket motor of the present invention, the sealing maintenance of the present invention may be ensured.

According to the present invention constituted by the solution means described above, there are the following effects.

First, in relation to the initiator for a racket motor according to the present invention, as the first gunpowder detonated by the foil ignition portion and the second gunpowder combusted by the first gunpowder are formed to contact each other, the internal structure of a sleeve may be simplified and the number of parts may be reduced, thereby improving the reliability. In addition, by a simple structure, manufacturing convenience may be increased and miniaturization may be easily realized.

Secondly, since the initiator for a rocket motor according to the present invention is formed such that a pin for voltage application is directly bonded to the surface of the foil ignition portion, a separate connecting component may be omitted. Therefore, miniaturization according to the reduction of the internal space may be possible, and the assembly process may be simplified.

Meanwhile, in relation to the initiator for a rocket motor according to the present invention, by a sealing member having the protrusion portion in the form of being inserted into the pin for electrical connection, the air tightness of the combustion chamber after ignition may be ensured.

On the other hand, as the sleeve assembly of the present invention is configured such that a wire is accommodated and fastened to a rocket motor, it is possible to prevent the weakening of the engagement of the initiator for a rocket motor and the rocket motor according to the present invention in multiple ways.

The above-described embodiments are merely examples for implementing an initiator for a rocket motor according to the present invention and the present invention is not limited to the above embodiments. It will be understood by those of ordinary skill in the art that various changes are possible therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An initiator for a rocket motor comprising:

a sleeve assembly including a hollow portion; and

an ignition assembly including a plug portion and a foil ignition portion,

wherein the plug portion is mounted on the sleeve assembly to close one side of the hollow portion and is configured to deliver an electrical signal to the ignition portion,

wherein the foil ignition portion is coupled to inside of the plug portion and is disposed adjacent to the hollow portion,

wherein the sleeve assembly comprises:

a first explosive charge accommodated in the hollow portion and disposed adjacent to the foil ignition portion and configured to be detonated by the foil ignition portion; and

a second explosive charge accommodated inside the hollow portion to contact the first explosive charge and configured to be deflagrated or combusted by the detonation of the first explosive charge,

wherein the plug portion comprises:

a body portion inserted in the sleeve assembly;

a plurality of pins extending into the body portion; and

a sealing member interposed between the body portion and each of the plurality of pins to surround an outer circumferential surface of each of the plurality of pins,

wherein the plurality of pins include accommodating grooves which are recessed at the outer circumferential surface of each of the plurality of pins, and

wherein the seating member includes a protrusion portion which protrudes into the accommodating grooves,

wherein each of the plurality of pins comprise an inner end facing the hollow portion, and wherein the inner end of the pin is formed as a plane cut surface configured to be adhered to a surface of the foil ignition portion,

wherein the foil ignition portion comprises:

an ignition layer including a bridge configured to be vaporized by applying a voltage thereto;

an insulating layer disposed on one side of the ignition layer and including a plurality of pin accommodating holes; and

a spacing layer disposed on the other side of the ignition layer and including a through hole formed to expose the bridge to the first explosive charge, and

wherein the first explosive is accommodated in a first hollow having a small inner diameter and a cylindrical space adjacent to the foil ignition portion in the hollow portion, and

the second explosive is filled in a second hollow which is a cylindrical space with a larger inner diameter than the first hollow and adjacent to the first hollow in the hollow portion.

2. The initiator of claim **1**, wherein an outer end of each of the plurality of pins is convex.

3. The initiator of claim **1**, wherein the accommodating grooves surround the outer circumferential surface of each of the plurality of pins, and the protrusion portion is annular to be accommodated in the accommodating grooves.

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